Newborn Hearing (Screening)

Clinical Preventive Service Recommendations

U.S. Preventive Services Task Force Recommendation

***Evidence Rating:* I (Insufficient Evidence)**

In 2001, the U.S. Preventive Services Task Force (USPSTF) issued an "I"-rating for "insufficient" evidence to recommend for or against routine newborn hearing screening. The USPSTF found inconclusive evidence to determine whether earlier treatment resulting from screening leads to clinically important improvement in speech and language skills at ≥ 3 years of age.[1] However, the USPSTF did note that there is evidence that the average age of diagnosis is significantly reduced with newborn hearing screening.

CDC Recommendation

***Evidence Rating:* Observational Studies, Expert Opinion**

The CDC recommends screening all children for hearing loss at birth.

The CDC recommendation for screening at birth is based on evidence from observational studies that children who receive intervention services for hearing loss before the age of 6 months develop significantly better language skills.[2-4] This is supported by expert opinion of those who care for children with hearing loss and parents of children with hearing loss, who report that children with hearing loss detected as infants have better language skills than older siblings with later-diagnosed hearing loss.

Other Recommended Guidance
Joint Committee on Infant Hearing (JCIH)

The Joint Committee on Infant Hearing (JCIH) endorses early detection of and intervention for infants with hearing loss (early hearing detection and intervention, EHDI) through integrated, interdisciplinary state and national systems of universal newborn hearing screening, evaluation, and family-centered intervention. Thus, all infants' hearing should be screened using objective, physiologic measures in order to identify those with congenital or neonatal onset hearing loss. Audiologic evaluation and medical evaluations should be in progress before 3 months of age. Infants with confirmed hearing loss should receive intervention before 6 months of age from health care and education professionals with expertise in hearing loss and deafness in infants and young children.[5]

Evidence Rating:

Expert Opinion

National Institutes of Health (NIH)

A 1993 National Institutes of Health (NIH) Consensus Development Conference Statement on Early Identification of Hearing Impairment in Infants and Young Children recommended that universal newborn hearing screening be implemented.[6]

Evidence Rating:

Expert Consensus

State Legislation

At present, 38 states and territories have enacted legislation on universal screening of all infants for hearing loss, and all states have programs to promote newborn hearing screening.[7]

Information Sources

The recommendations and supporting information contained in this document came from several sources, including the:

- American Academy of Audiology

- American Academy of Pediatrics (AAP)
- American Speech, Language, and Hearing Association
- Centers for Disease Control and Prevention (CDC)
- Directors of Speech and Hearing Programs in State Health and Welfare Agencies
- Joint Committee on Infant Hearing (JCIH)
- Health Resources and Services Administration (HRSA)
- National Center for Hearing Assessment and Management (NCHAM)
- National Institutes on Health (NIH)

The background and supporting information contained in this document is a compilation of research findings. All information presented in this document should be attributed to its referenced source and should not be considered a reflection of other organizations cited in the text.

Condition/Disease Specific Information

Epidemiology of Condition/Disease

Congenital hearing loss affects approximately 3 per 1,000 children.[8] About 30% of children with hearing loss have another condition at birth. Hearing loss, even loss that is mild in magnitude or unilateral (only one ear affected), can affect a child's potential to develop speech, language, social skills, and school performance, including grade retention.[9] Hearing loss may be present at birth or may occur later.

Condition/Disease Risk Factors

About 40% to 60% of hearing loss is due to genetic or gene-environment factors. The causes of hearing loss for many children are poorly defined, and infants may have no identifiable risk factors to prompt targeted screening. But assorted risk factors are known. Some cases occur in families with a history of permanent childhood hearing loss. Infections such as bacterial meningitis or *in utero* cytomegalovirus (CMV), herpes, toxoplasmosis, and rubella are associated with hearing loss. Anatomical anomalies, caused either by birth defects or trauma or other factors are also associated with hearing loss. Finally, a variety of other predispositions such as severe neonatal hyperbilirubinemia (jaundice) requiring exchange transfusion or persistent otitis media are associated with hearing loss.[10]

Value of Prevention

Economic Burden of Condition/Disease

Many people with hearing loss need long-term services. The average lifetime cost for one person with early-childhood-onset hearing loss is estimated to be $417,000 (in year 2003 dollars).[11] It is estimated that the *lifetime* cost for all people with congenital hearing loss who were born in 2000 will total $2.1 billion (in year 2003 dollars).[11] These costs include both direct and indirect costs. Direct medical costs, such as doctor visits, prescription drugs, and inpatient hospital stays, make up 6% of these costs. Non-medical expenses, such as home modifications and special education, make up 30% of the costs. These estimates do not include other expenses, such as hospital outpatient visits, sign language interpreters, and family out-of-pocket expenses.

Workplace Burden of Condition/Disease	Indirect costs of hearing loss, which include the value of lost wages when a person either cannot work or is limited in the amount or type of work possible, make up 63% of total costs.[11]
Economic Benefit of Preventive Intervention	The economic benefits of newborn hearing screening include reduced special education costs associated with improved hearing and language and also lower social and community services. A new study from England has reported that average education costs among 7 to 9 year-old children with bilateral hearing loss were lower by 22% among children born in districts with universal newborn hearing screening.[12]
Estimated Cost of Preventive Intervention	The cost of screening for hearing loss depends on the location (inpatient or outpatient setting), provider type, and the screening instrument used. In 2004, the private-sector cost of screening for hearing loss in the hospital (recommended setting) averaged $84 if billed and paid separate from the labor and delivery charge; approximately 95% of paid claims fell within the range of $0 to $200.[13] If the screening was missed before discharge or needed to be repeated on an outpatient basis, the average private-sector cost was $98 (in this scenario 95% of paid claims fell within the range of $0 to $235).[13] Both figures include the cost of staff time, consumables, and the cost of the equipment. When screening is billed as a part of labor and delivery charges the incremental cost is lower.
Estimated Cost of Treatment	The cost of treatment will vary widely depending on the type and severity of the hearing loss and the kinds of interventions chosen.
Cost-Effectiveness and/or Cost-Benefit Analysis of Preventive Intervention	Screening programs detect approximately 3 children with hearing loss for every 1,000 infants screened. Assuming an average cost of $30, the cost per infant detected may be as low as $10,000. In comparison to other preventive interventions and to commonly accepted cost-effectiveness benchmarks, newborn hearing screening is cost-effective. The cost-effectiveness of early detection depends on long-term outcomes. To the extent that improved language leads to lower special education costs and to improved learning potential, the monetary benefits of screening are likely to exceed the costs.[14-15] The savings in special education costs are likely to exceed the costs of screening within 5 years.[12]

Preventive Intervention Information

Preventive Intervention: Purpose of Screening	Screening newborn infants for hearing loss identifies most children with congenital hearing loss prior to the onset of language development, allowing their parents to access services much earlier than otherwise. In the absence of screening, the majority of children with congenital hearing loss do not receive a diagnosis until 2 to 3 years of age, by which point language development is usually seriously delayed.[16] The average deaf or hard-of-hearing adult reads at only a 4th grade level.[17] The average language development score of children who are deaf or hard of hearing in the absence of early identification is two standard deviations below the mean.[2]

Certain children have later-onset or progressive hearing loss that cannot be detected during the newborn period. Clinicians and parents should be alert to hearing, speech, language, or developmental delay and should have children tested for hearing function if they are concerned about delays regardless of previous hearing screenings.

Benefits and Risks of Intervention

With screening, most cases of hearing loss can be detected prior to 3 to 4 months of age. With early identification, parents have the opportunity to communicate with their child beginning early in infancy. This aids language development for the child and strengthens the parent-child bonding. Research suggests that most preschool-age children with hearing loss will have language development within the normal range if intervention beginnings by 6 to12 months of age.[2-4] It is widely believed that this will lead to improved school performance and occupational success.[12,14-15]

The main risk of screening is that false-positive results can lead to additional screening or evaluation, incurring unnecessary costs and inconvenience for families and providers. The expected number of newborns who do not pass the hearing screen is 40 per 1,000 births, of which 3 will have hearing loss. Following and re-testing the remaining 37 incur costs and challenge follow-up systems. On the other hand, a number of surveys of families whose children screened positive for hearing loss found that most parents support hearing screening and consider the inconvenience to be minor compared to the benefits of early recognition.[18]

Initiation, Cessation, and Interval of Screening

Hearing screening for newborn infants is mandated in many jurisdictions, and CDC recommends it for all infants.

Since hearing loss may develop or first become apparent later, infants and children and should also be screened when a clinician suspects that language or developmental delay may be related to hearing loss. Physicians should be encouraged to see that patients at high-risk for late-onset or progressive hearing loss be screened in accordance with recommendations set forth by the Joint Committee on Infant Hearing (JCIH).[5]

It is recommended by the JCIH that infants with risk indicators for progressive or delayed-onset hearing loss should receive audiologic monitoring before age 3 years.[5] In addition, an infant who does not pass a newborn screening should get a diagnostic audiological evaluation before 3 months age at the latest.

Intervention Process

Hospital-based screening programs should use automated audiologic screening instruments approved for use with newborn infants. This type of instrumentation is also appropriate for use in pediatrician and other provider offices, but very few of these offices provide this type of screening. Those offices that do not have the appropriate instrumentation and training should refer to audiological practices that do provide this service. Infants who are suspected to have hearing loss on the basis of the initial screening test should be referred for comprehensive audiologic assessment and specialty medical evaluations to confirm the presence of hearing loss and to determine type, nature, options for treatment, and (whenever

possible) etiology of the hearing loss.[5] Audiological diagnosis requires a test-battery approach to cross-check results of multiple physiologic and developmentally-appropriate behavioral measures. Early audiologic assessments rely on physiologic measures of auditory function including: Auditory Brainstem Response (ABR), Otoacoustic Emissions (OAE), acoustic immittance measures, and acoustic reflexes.[19]

Auditory Brainstem Response (ABR) is a test that checks the brain's response to sound and is measured by placing electrodes on the head to record the brain's response to sound. Older babies, as well as those who do not routinely sleep well after eating, frequently require sedation to attain accurate ABR test results.[19] Otoacoustic Emissions (OAE) is a test that checks the inner ear response to sound and is measured by placing a very sensitive microphone in the ear canal to measure the ear's response to sound. Either type of instrument can be used alone or in sequence. Evidence is mixed as to what instrument or method is most effective in accurately identifying children with hearing loss, but most instruments seem to have an adequate level of sensitivity and specificity.[19]

Treatment Information

Health benefits should include provisions for diagnostic, surveillance, and treatment services.

Infants with a diagnosed hearing loss should receive appropriate services before 6 months of age, including medical services, early intervention services (i.e., Part C services or other state approved intervention services), and audiologic services.[5,20]

Every infant with confirmed hearing loss should be referred for an otolaryngology medical evaluation to determine the etiology of hearing loss, to identify related physical conditions, and to provide recommendations for treatment as well as referral for other services, including genetics evaluation and counseling. The clinician should refer families to a source of information about qualified early intervention service providers and the state Universal Newborn Hearing Screening (UNHS)/Early Hearing Detection and Intervention (EHDI) program. In many states, clinicians are required to report children with hearing loss to the state program.

Strength of Evidence for the Clinical Preventive Service

The level of evidence supporting the recommendations contained in this section is described below.

Recommended Guidance:

Centers for Disease Control and Prevention (CDC)
Strength of Evidence: Observational Studies, Expert Opinion

- The CDC found evidence to support universal newborn hearing screening at birth. The CDC recommendation is based on evidence from observational studies that children who receive intervention services for hearing loss before the age of 6 months develop significantly better language skills. This is supported by expert opinion of those who care for children with hearing loss

and parents of children with hearing loss, who report that children with hearing loss detected as infants have better language skills than older siblings with later-diagnosed hearing loss.[2-4]

The Joint Committee on Infant Hearing (JCIH)
Strength of Evidence: Expert Opinion

- JCIH endorses early detection of and intervention for infants with hearing loss (early hearing detection and intervention, EHDI) through integrated, interdisciplinary state and national systems of universal newborn hearing screening, evaluation, and family-centered intervention. Thus, all infants' hearing should be screened using objective, physiologic measures in order to identify those with congenital or neonatal onset hearing loss. Audiologic evaluation and medical evaluations should be in progress before 3 months of age. Infants with confirmed hearing loss should receive intervention before 6 months of age from health care and education professionals with expertise in hearing loss and deafness in infants and young children.[5]

National Institutes of Health (NIH)
Strength of Evidence: Expert Consensus

- A NIH Consensus Development Conference Statement on Early Identification of Hearing Impairment in Infants and Young Children recommended that universal newborn hearing screening be implemented.[6]

State Legislation
Strength of Evidence: Not Specified

- At present, 38 states and territories have enacted legislation on universal screening of all infants for hearing loss, and all states have programs to promote newborn hearing screening.[7]

Note: In 2001, the U.S. Preventive Services Task Force (USPSTF) issued an "I"-rating for "insufficient" evidence for newborn hearing screening, as a result of a lack of randomized controlled trials evaluating outcomes from newborn hearing screening.[1] However, the USPSTF did note that there is evidence that the average age of diagnosis is significantly reduced with newborn hearing screening.

Authored by:

Grosse S. Newborn hearing evidence-statement: screening. In: Campbell KP, Lanza A, Dixon R, Chattopadhyay S, Molinari N, Finch RA, editors. *A Purchaser's Guide to Clinical Preventive Services: Moving Science into Coverage*. Washington, DC: National Business Group on Health; 2006.

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